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TEAMx cold-air pool model intercomparison study

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Cold-air pools pose a significant challenge for numerical weather prediction models, primarily because they are often characterized by very stable stratification. Traditional surface-layer parameterizations, which rely on Monin-Obukhov similarity theory, tend to be ineffective in these conditions. Additionally, the processes involved are highly localized and occur on small spatial scales, necessitating models with high horizontal and vertical resolutions. Within the TEAMx research programme, a model intercomparison study is being undertaken. The goal is to assess how well various numerical weather prediction models, each with a horizontal grid spacing of 1 km, can simulate a nocturnal cold-air pool within an Alpine valley. Five models are currently participating in the intercomparison study, including both operational and research models, specifically AROME, ICON, Meso-NH, the Unified Model, and WRF. For the intercomparison, a case study was selected from a multi-day undisturbed period during the PIANO (Penetration and Interruption of Alpine Foehn) field campaign conducted in the Inn Valley, Austria, in fall 2017.

The presentation will show first results from the model intercomparison study. An extensive dataset is available for model evaluation from the PIANO measurement campaign, including vertical profiles of wind, temperature, and humidity from multiple Doppler wind lidars and a microwave temperature and humidity profiler, surface observations including surface-energy fluxes from multiple automatic weather stations and eddy-covariance stations, and spatially distributed temperature measurements from a dense network of temperature sensors. The model evaluation and intercomparison covers the entire lifecycle of the cold-air pool, from its initial formation in the afternoon to its dissipation the following day. The analysis addresses specifically the question of how well the simulations represent the cold-air pool's characteristics, such as its intensity, vertical structure, and spatial heterogeneity, and the processes contributing to the temporal evolution and spatial structure of the cold-air pool.